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lege presidents who hold that position on account of special training. I agree also as to the unit of organization consisting of the school or department, that being the natural and logical unit. I also agree in the main with the machinery proposed in paragraph (4). The only inadvisable thing, to my mind, would be the constitution of a permanent board of advisers—if you mean it to be permanent. I would add that it might be wise to set a time limit upon the deanships—or directorships—whatever you care to call them. Personally, I doubt very seriously whether a single individual should be the controlling force in a department for more than ten years. Your fifth section, which proposes the senate and the plenums, I think is also desirable. I assume that this senate and the plenums would legislate regarding the educational policy rather than regarding the financial policy.

I heartily approve of your scheme for university control. In our university, as in others, the head of a department has altogether too much power—or uses it too arbitrarily. In fact, members of the faculty scarcely dare to oppose his plans or to vote against his reelection, for fear of reprisals, unjust discriminations, etc. Thus a president or head of a department may become a sort of dictator, or like a political “boss.”

Your reprint is a very moderate statement of the evils arising from the present system of college and university control. The worst of these evils is probably its discouraging and deterrent effect upon the men exercising the teaching functions in this class of institutions. And if this system continues without essential modifications, this form of its evil results is likely to grow with constantly accelerating rapidity. Self-respecting and gifted and independent men will not choose a career which may at any time be cut short or even totally ruined by the caprices of a presidential “boss.” For myself, and much as I love and highly as I prize the office of the teacher, I should hesitate long before accepting, were I again young and asked, under the changed

conditions, to enter the life of a college or university professor. As in all similar cases, the remedy is by no means so clear as are the evils demanding a remedy. I am inclined to think that the details of any change of plan would need to differ in different institutions. Certainly they could not be precisely the same for the private and the state institution. And in both cases, care would not be of small importance to avoid changing the benevolent despot for the uncontrolled mob. It would seem also that some means should be devised for placing the control of instruction and the control of finances in largely different hands, while securing frank and cordial intercourse between the two.

SCIENTIFIC BOOKS

The Biology of the Seasons. By J. ARTHUR THOMSON. Illustrated by WILLIAM SMITH. New York, Henry Holt and Company. 1911.
The Natural History and Antiquities of Selborne, in the County of Southampton. By GILBERT WHITE. With illustrations in color by GEORGE EDWARD COLLINS, R.B.A. London, Macmillan & Company. 1911.

It is worth while to consider these two books together, for resemblances and contrasts. They are typical of the centuries to which they belong, of the old and the new in natural history. Professor Thomson points this out, in his introductory chapter. “The older naturalists—before Darwin’s day—made many careful pictures of the life of plants and animals as it is lived in nature. The indefatigable patience, the keen observation and the sympathetic insight of many of these pre-Darwinian naturalists must remain as models to which in these later days, with improved methods, we try to approximate. Gilbert White’s ‘Selborne,’ above all, remains ever-green. But the old records are for the most part contributions to Natural History rather than to Biology. To most of their authors there was wanting the biological key which Darwin first taught men to use.” But in post-Darwinian writings “biological ideas have become dominant; analysis has become more penetrating; the pictures have a broader

perspective and a deeper insight." In the books before us, however, there is a contrast in the attitude toward the reader as well as toward the subject. Listen to Gilbert White: "If the writer should at all appear to have induced any of his readers to pay a more ready attention to the wonders of the Creation, too frequently overlooked as common occurrences; or if he should by any means, through his researches, have lent a helping hand towards the enlargement of the boundaries of historical and topographical knowledge; or if he should have thrown some small light upon ancient customs and manners, and especially on those that were monastic, his purpose will be fully answered." Simplicity and humility enough, but the offering consists of his own "researches," presented in the hope of somewhat enlarging the bounds of human knowledge. Now Professor Thomson: "That the method of seasonal biological study is educationally sound is best proved by experiment. But it is perhaps enough to ask the simple question: *What kind of scientific lore concerning living creatures would we most naturally teach our children in spring?*" The attitude is pedagogical throughout: the author has come to instruct—as pleasantly and interestingly as may be, but never forgetting that he is a teacher. The book does not set forth the "researches" of the writer, or, if doing so, makes little of them; it is a contribution to pedagogy, based on compiled materials of every kind. There is nothing of the artless art of Gilbert White, nor indeed (in spite of Selbornian imitators) is such a thing quite possible in this sophisticated age.

All things considered, Professor Thomson's book is a charming example of popular scientific writing, and we would recommend it to those who have some knowledge of the matters whereof it treats. The other day I took occasion to read one of the chapters (The Tale of Tadpoles) to a large university class in biology, and in so doing came to highly appreciate its merits, and at the same time notice what seemed to be its faults. It is extremely suggestive, so that all along the line one is tempted to interject new arguments and facts.

The whole book is just a little uncritical, the author having a field so wide that he can not quite master all the details, so that at times he takes little doubtful data on trust, and at others is perhaps led somewhat astray by his own rhetoric. This must be the fate of all popular writers and teachers, indeed of all university professors. As one of our most brilliant researchers and teachers put it in conversation recently, there is always this dilemma: if you make yourself quite clear and strive to be perfectly logical, you do it at the expense of some of the truth, because in dealing with biological matters you are never really free from difficulties and uncertainties. If you go to the other extreme, you merely produce confusion. Substantially, the method so excellently typified by Professor Thomson's writings is abundantly justified and sufficiently accurate, but critical readers will always wish that some things had been stated rather differently.

Another fault in the book reviewed is, I think, an undue tendency to use words which are not likely to be understood by the general reader. Even in the reading just mentioned, to a more or less instructed class, I found myself frequently translating. Against this objection must be set the undeniable fact that the author's rich vocabulary enables him to state things more accurately and briefly than would be possible were he to use only the poor English of the street.

There still remains the question whether popular science, as presented to-day by Professor Thomson and a number of other eminent men, has not swung too far away from the standpoint of Gilbert White. Is there not some danger of becoming too professional, too pedagogical? Is it too much to say that we can not have a real diffusion of culture in these matters until we have more of the spirit of the amateur?

The new edition of "Selborne" has a most attractive appearance. It is reprinted from the original without any alterations or annotations; there is not even an editorial note. The numerous colored plates are pleasing, yet I think not wholly satisfactory. In many the

outlines are too hard and the colors not quite true; there is too much of the mannerism of the artist. The colored plates in Professor Thomson's book also seem to me criticizable; they look a little out of focus, as it were—much as things look to the present writer when he has mislaid his glasses.

On the chance that some of our active workers in genetics have not recently read their "Selborne," it may be worth while to quote the following pertinent information: "One thing is very remarkable as to the sheep: from the westward till you get to the river Adur all the flocks have horns, and smooth white faces, and white legs; and a hornless sheep is rarely to be seen: but as soon as you pass that river eastward, and mount Beeding-hill, all the flocks at once become hornless, or, as they call them, poll-sheep; and have moreover black faces with a white tuft of wool on their foreheads, and speckled and spotted legs: so that you would think that the flocks of Laban were pasturing on one side of the stream, and the variegated breed of his son-in-law Jacob were cantoned along on the other. And this diversity holds good respectively on each side from the valley of Bramber and Beeding to the eastward, and westward all the whole length of the downs. If you talk with the shepherds on this subject, they tell you that the case has been so from time immemorial, and smile at your simplicity if you ask them whether the situation of these two different breeds might not be reversed. However, an intelligent friend of mine near Chichester is determined to try the experiment; and has this autumn [1773], at the hazard of being laughed at, introduced a parcel of black-faced hornless rams among his horned western ewes. The black-faced poll-sheep have the shortest legs and the finest wool."

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THE HINDU-ARABIC NUMERALS

IN a recent number of SCIENCE¹ I ventured to assert the correctness of the statement that our present decimal place system with the zero

¹ January 5, 1912.

is of Hindu origin. The veteran historian of mathematics, Moritz Cantor, makes substantially the same assertion in the latest edition (1907) of the first volume of his "Vorlesungen über Geschichte der Mathematik," p. 608. He says, referring to the use of words with place value.²

This kind of conscious juggling with the notions of positional arithmetic together with the zero, is most easily explained in the home of these notions, which (home) for us is India and this we may affirm even if there is question of a second home. We mean if both notions were born in Babylon, of which there is great probability, and were carried over into India in a very undeveloped state.

We may add that neither Cantor nor any other has yet presented any historical evidence that these ideas were carried over to India from Babylon. Eneström, the editor of the *Bibliotheca Mathematica*, a journal devoted to the history of mathematics, has recently³ supported the view that the Babylonian arithmetic is not of the same nature as our system. The Babylonians did not use the zero, so far as we know, with the same notion of place value for purposes of computation as in the Hindu system. The Babylonian multiplication tables published by Hilprecht which include tables of 1,800 times various numbers are an evidence of this fact. In a fully developed sexagesimal (60) system this table would be replaced by the table of thirty times the corresponding numbers, since 1,800 equals 30 times the unit of higher order, 60. Furthermore, the Babylonian system was not adapted for computation because of the mixture of decimal and sexagesimal systems and further because of the large base, 60.

Recently another early document referring to the Hindu numerals has been published. This document is of prime importance because, being written in 662 A.D., it antedates by more than two centuries the earliest known appearance in the ninth century of the numerals in Europe. The probability is, too, that the

² See Smith-Karpinski, "The Hindu-Arabic Numerals," p. 39, for an explanation of this system.

³ *Bibliotheca Mathematica*, Vol. XI. (3), 1911, p. 331.